AUTOMOTIVE WHEEL WITH IMPROVED INFLATION SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to automotive wheels of the type designed for use with pneumatic tubeless tires, and more particularly to wheels of the type described which utilize special inflation systems that are employed for inflating the associated tubeless tires. Even more specifically this invention relates to an improved such wheel having formed inside the hub face of the wheel a network of air passages for use with an inflation system of the type described.

It has long been customary to employ with certain types of vehicles special automotive wheels connected to a central tire inflation system (CTIS), for example an on-board pump for producing compressed air to be transferred through various wheel-mounted valves and hoses to the tubeless tires that are mounted on the vehicle's wheels. For example, a wheel of the type disclosed in U.S. Patent No. 4,836,261 employs an inflation valve which is secured to the wheel rim between its bead retaining flanges so that an outlet port of the valve communicates with the interior of the tubeless tire on the rim. The inlet port to the valve, on the other hand, is connected by a tubular valve stem to an opening in the outwardly facing section of the rim where it is secured in position to receive compressed air from a supply thereof

Systems of the type noted above function very well when the goal is simply to introduce air into a tire and to maintain it there until it is purposely evacuated or subjected to a blowout, or the like. However, in some cases, such as in the case of a military wheel, it is not unusual to require multiple air pressure settings, such as for example when the vehicle is traveling over rough, off road terrain, in mud or snow, or on hard paved surfaces. Operation on these various terrains require different air pressure settings for the tires in order to optimize the tractability of the vehicle. To effect a change in the air pressure without stopping or leaving the vehicle, it heretofore has been necessary to bolt or otherwise secure to the outside of the associated wheels certain elements of the inflation system, thus creating tire imbalance, and potential breakage or damage to the exposed inflation components, and increasing the overall weight and cost of the inflation system.

It is an object of this invention, therefore, to provide an improved automotive wheel which significantly eliminates the need for many of the components heretofore employed in tire inflation systems of the type described, thus eliminating many of faulty leak sites that exist in such prior systems.

Still another object of this invention is to provide an improved automotive wheel of the type described which not only is designed for use in connection with a central inflation system, but which also utilizes improved means for preventing any undesirable leakage of compressed air from the tubeless tire mounted on the wheel.

A more specific object of this invention is to provide an improved wheel of the type described wherein the numerous air passages for conveying air to and from the tubless tire thereon are formed internally of the wheel rim itself, and within the cross section thereof.

Other objects of this invention will be apparent hereinafter from the specification and from the recital of the appended claims, particularly when read in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

A wheel for a tubeless tire is made in the form of a circular rim having outwardly flaring circumferential flanges on opposite ends thereof for engagement by the beads of a tubeless tire mounted on the rim. Intermediate its ends the rim has a wall extending transversely of its axis and the wall has therethrough a central opening disposed coaxially of the rim.

To control air flow to a tire on the rim the transverse wall has therein a first air duct which opens at one end on the outer periphery of the rim for communication with the interior of the tire mounted thereon, and opens at its opposite end on the outboard or outwardly facing side of the wall.

A second air duct is formed within the wall section to open at one end on the outboard side of the wall, and to open at its opposite end on the opposite or inboard side of the wall for connection to a central tire inflation system. Air flow is controlled by a tire inflation control valve which is secured to the outboard side of the wall, and which has therein a pair of air inlet/outlet ducts sealingly secured in communication at the outboard surface of the wall with its first and second ducts, respectively.

THE DRAWINGS

Fig. 1 is a cross sectional view through the center of a circular, automotive wheel made according to one embodiment of this invention, portions of the tire mounted on the wheel being shown fragmentarily and in phantom by broken lines;

Fig. 2 is an exploded, fragementary view of the of the wheel as shown in Fig. 1, by means of which the associated air valve and its mounting bolts are shown as they appear before the valve is bolted to the face of the wheel; and

Fig. 3 is a fragmentary perspective view of a portion of the wheel as shown in Fig. 2, and with the valve and its mounting bolts or screws again being shown in an exploded format as they appear before being secured to the outer face of the wheel.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings by numerals of reference, Fig. 1 is an axial section view through the center of a two piece wheel comprising a circular, outer rim section denoted generally by the numeral 10, and an inner, circular rim section denoted generally by the numeral 20. Intermediate its ends the outer rim section 10 has an annular wall section 11 surrounded at its open outer end by an integral, outwardly flaring circumferential flange section 12, and is closed at its inner end by an integral, transversely extending wall section 13. Section 13 has therethrough, and centrally thereof, a reduced-diameter opening 14 which is disposed coaxially of section 10, and which is surrounded coaxially by a circular array of smaller, circular openings 15 (Fig. 2) which are equiangularly spaced from each other about the axis of section 10, and in rather slight, radially spaced relation to the central opening 14. At their outer ends (their upper ends in Fig. 1) the openings 14 and 15 open upon a shallow, circumferential recess 16 formed coaxially in the otherwise plane outer (upper in Fig. 1) surface 17 of the wall section 13. Radially outwardly of the circular array of openings 15 the wall section 13 has formed coaxially in the inner side thereof (the lower side in Fig. 1) a circumferential, annular recess 18 opening at one end on the annular wall 11, and having a plane bottom surface which registers with, and extends parallel to, the plane outer surface 17 of the section 10.

As shown more clearly in Fig. 1, the inner rim section 20 also is generally cup-shaped in configuration, and like section 10 has intermediate its ends an annular wall section 21 having a diameter substantially equal to the annular wall section 11 of the outer rim section 10, but which happens to have an axial length substantially greater than the axial length of the section 11. Remote from its flanged open end 22 the annular wall section 21 has integral therewith a wall section 23 which extends transversely of the axis of sections 10 and 20, and which has therethrough coaxially of the sections 10 and 20 a centrally disposed, circular opening 24. The bore wall of opening 24 surrounds and is coaxially engaged with the radial inner end or bottom of the recess 18 in wall section 13 of the rim section 10. Wall section 23 also has thereon a plane, flat outer surface 25 having formed therein adjacent the outer peripheral surface of the annular wall section 21, a rather shallow, circular recess 26 disposed coaxially of the section 20 for a purpose noted hereinafter.

To assemble the two sections 10 and 20 to form a wheel for accommodating a tubeless tire T, a resilient O-ring 27 is seated in the circular recess 26, which is nearly semi-circular in cross sectional configuration, so that a good portion of the O-ring projects from the recess 26. The wall section 23 of the inner rim section 20 is then seated in the circumferential recess 18 in the wall section 13 of section 10, and in such manner that a circular array of circular openings in the section 13 register with a like, array of circular openings in the section 23. These registering openings accommodate the externally threaded shanks of an array of bolts 28, which extend through the registering openings in the sections 13 and 23 in order to fasten those sections securely together by nuts 29 that are screwed to the various bolts 28 in a conventional manner. When the sections 13 and 23 are thus bolted together, the plane surface 25 on section 23 is secured into coplanar engagement with the planar surface formed on section 13 by the recess 18, and in such manner that the O-ring 27 is compressed by the surface of section 13 to form an airtight seal between the two rim sections 10 and 20 adjacent the outer peripheral surface of the annular sections 11 and 21 thereof. As shown in phantom by broken lines in Fig. 1, the tubeless tire T can then be mounted on the assembled wheel as shown in phantom by broken lines in Fig. 1, with the outboard and inboard beads of the tire being seated against the respective flange sections 12 and 22.

In order to be able to supply air under pressure to a tubeless tire mounted on a two piece wheel rim comprising the sections 10 and 20, the outer rim section 10 has formed in its wall section 13 adjacent and parallel to the plane surface 25 thereof a radially extending air duct 41, which is circular in cross section, and which opens at its outer end on the outer peripheral surface of the annular wall section 11. Duct 41 communicates at its inner end with the lower end of a small, circular opening 42, which is formed in the bottom of the shallow recess 16 in wall section 13 adjacent the outer peripheral surface of the recess 16. At a point spaced radially inwardly from the opening 42, another small, circular opening 43 is formed in the bottom of the shallow recess 16, and registers coaxially at its inner end (the lower end in Fig. 1) with the inner end of a slightly enlarged-diameter counterbore 44 which is formed in the inner surface of the wall section 13 coaxially of the opening 43.

A conventional central tire inflation valve such as offered for sale, for example, by C. M. Automotive, and which is denoted generally by the numeral 50, has therein a pair of spaced, parallel air inlet and air outlet ducts 51 and 52, respectively, which as shown in Fig. 2 open at their outer ends on a plane, flat bottom

surface 53 of the valve, and which communicate at their inner ends to a conventional valve mechanism (not illustrated) which is housed in a recess 54 within the valve 50. Where they open on the surface 53, the outer ends of the ducts 51 and 52 are surrounded by resilient O-rings 55 which are disposed to be seated in and project partially from circular, registering recesses that are formed in surface 53 to surround the outer ends of ducts 51 and 52 in radially spaced relation thereto. Valve 50 is disposed to have its plane bottom surface 53 secured snugly and in coplanar relation with the plane, bottom surface of the recess 16 in wall section 13 by a plurality (four in the embodiment illustrated) of bolts or screws 56, and in such manner that the outer end of duct 52 registers with the opening 42 in wall section 13, and the outer end of the duct 51 registers exactly with the opening 43 in wall section 13. In this manner the duct 41 is placed in communication with valve duct 52, while opening 43 and its associated counterbore 44 are placed in communication with the valve duct 51. Also, and very importantly, the O-rings 55 which surround the outer ends of the ducts 51 and 52 are sealingly engaged by and compressed by the plane bottom surface of the recess 16 in wall section 13. Duct 41 thus remains sealingly connected to valve duct 52 and valve duct 51remains sealingly connected to opening 43 and its counterbore 44, and as noted hereinafter, to any portion of the central tire inflation system that is designed to be connected to counterbore 44.

In use, openings 15 are adapted to accommodate the studs normally employed for securing the wheel 10 to the axle of a vehicle, and in which case the inner rim section 20 faces inwardly of the vehicle, and rim section 10 faces outwardly. The inwardly facing counterbore 44 of the wall section 13 forms an inlet interface for accommodating the component (not illustrated) which is employed to connect the valve inlet duct 51 to a central tire inflation system, or the like. For this purpose the surface of the wall section 13 at the outer end of the counterbore 44 ideally would be provided with a circular recess 57 disposed coaxially about the outer end of counterbore 44 for accommodating an O-ring (not illustrated), which would be utilized to provide a sealed connection between the air filtration system component, or the like, which is connected to counterbore 44. When such a system is connected to the counterbore 44, such connection would be located within the inner rim section 20 therefore leaving the sealed valve 50 being the only element or component of the system disposed outside of the hub face of the wheel. Air supplied by the system would then pass through the valve inlet duct 51, the valve control mechanism, the outlet duct 52 and the supply inlet duct 41 to the interior of the tire T. Conversely, air

released by the system from the tire would pass in the reverse direction through valve 50 and under the control thereof.

While the invention has been described in detail above in connection with a two-piece tire rim or wheel, which by way of example may be made from forged aluminum, or the like, it will be apparent that this invention is capable of being employed with different types of wheels, such as for example a one-piece wheel or even a multi-piece wheel such as for example the type disclosed in the above-noted U.S. Patent No. 4,836,261. By way of example, in a one-piece wheel the wall section 23 could be integral with the registering portion of the wall section 13 in which case the duct 41 and the openings 42, 43 and counterbore 44 would be formed in a one-piece unit rather than being formed in two separate sections 10 and 20. In the event that multiple sections are employed, the principle would be the same. The valve 50 would be the only component of the overall tire inflation system disposed on the outer surface of the rim hub, and would have its ducts 51 and 52 registering with openings in other air ducts which would be formed completely within other sections of the wheel. Also, it is to be understood that the illustrated valve 50 is only one of a number of conventional type valves which can be employed for producing a central tire inflation system of the type referred to above. In any case, the advantage of employing air routing ducts or routes that are located inside of the face of the wheel, and more specifically internally of the cross section of the wheel, is the fact that there will be a considerable reduction in the installation and maintenance costs as compared with prior such systems, as well as a significant reduction in the overall weight of the system. In the event that a two-piece wheel of the type described is employed with the system, the use of the resilient O-ring 27 in the recess 26 in the rim section 20 provides a simple and very effective way of preventing any undesirable leakage of air from an associated tire between the two sections 10 and 20 of the wheel.

Moreover, while this invention has been illustrated and described in detail in connection with only certain embodiments thereof, it will be apparent to one skilled in the art that the invention is capable of still further modification, and that this application is intended to cover any such modifications as may fall within the scope of one skilled in the art, or the appended claims.